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Foreign Direct Investment, Technology Diffusion, and Host Country Productivity Growth

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Asian Development Bank

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Contents

Abstract

The principal objective of this paper is to ascertain whether foreign direct investment (FDI) has statistically significant effects on host countries' economic performance, such as total factor productivity. Such effects are often referred to as FDI externalities or spillover effects. This paper attempts to evaluate whether these spillover effects depend on the sending countries' income levels. Our empirical analysis shows that FDI exerts positive impacts on less developed countries. Further, we determine that the impacts of FDI from developed countries are more prevalent. So-called North–South effects were confirmed; however, we do not detect South–South effects. We also investigated the other channel, imports, and demonstrate its significant impacts on total factor productivity.

I. Introduction

There is widespread agreement among economists that foreign direct investment (FDI) performs a critical function in the current process of globalization; it is frequently proposed to be beneficial for both the host and home countries.[1] The existing literature suggests that FDI brings a number of beneficial effects to host countries: (i) technology spillover effects, (ii) backward and forward linkage effects, (iii) trade effects, (iv) competitive and anticompetitive effects, and (v) growth/development effects. This paper focuses specifically on the productivity spillover effects of FDI flows.

The effect of FDI on a host economy's productivity has become a matter of great interest, and remains a contentious issue. Foreign investment is often purported to raise the productivity of the receiving firm or firms in their geographical proximity. Moreover, there is also a question as to whether FDI makes an investing firm more productive by providing it with access to superior technology.[2] Considering these direct implications, it is unsurprising that FDI has gained attention among international economists.

However, the extensive attention afforded to the topic thus far has produced few empirical studies explaining the effects of FDI with technology spillover in the context of South–South FDI flows. In fact, a growing body of literature focuses on either North–North or North–South FDI flows. This gap in the literature leaves crucial questions unaddressed, for example: To what extent can the role of FDI flows in spillovers be determined, and can the unique characteristics of South–South FDI flows be distinguished?

Noting the effects of South–South FDI on host countries can prove useful for several reasons. First, statistics confirm the growing importance of South–South FDI. According to the United Nations Conference on Trade and Development's *World Investment Reports* (UNCTAD 2004, 2005, 2006, and 2008), FDI inflows from developing economies reached their highest point in 2007, and the majority of these investments have contributed to economic growth in host countries. Second, FDI from South countries follows a different

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[1] The World Bank (1993) notes that FDI brings considerable benefits: technology transfer, management know-how, and export marketing access. Many developing countries will need to become more effective in attracting FDI flows if they are to close the technology gap with high-income countries, upgrade their managerial skills, and develop their export markets.

[2] FDI has long been considered an important channel for technology diffusion. After all, FDI theory holds that firm-specific technology is transferred across international borders by sharing technology among multinational parent companies. However, it is difficult to summarize the existing evidence on the importance of FDI for international technology spillover. This is, because first, it frequently derives from irreconcilable modes of analysis. Second, even for a particular type of analysis, key results are currently in process. See Keller and Yeaple (2003) for details.

pattern compared to the pattern associated with FDI from North countries. For example, South–South FDI might be more resistant to economic crises than North–South FDI in host countries. Moreover, as multinational enterprises (MNEs) from the South generally prefer local hires, South–South FDI provides a flexible countermeasure against political and economic conditions in host countries, in addition to lower overhead costs (Wells 1983). Third, the growing importance of South–South FDI indicates that the government's attempts to attract FDI should also focus on inflows to the South. This would constitute a significant change in the political implications of FDI.

This paper explicitly links the analysis of FDI to a core question in international trade: the role of FDI in technology spillover and growth particularly in three contexts: North–North, North–South, and South–South FDI flows. This study consists of: (i) a discussion of how FDI flows spill over and contribute to growth in general, particularly in the case of South–South FDI flows, and (ii) a comparative study of empirical analyses of FDI spillovers and growth. Particular attention is paid to South–South flows involving Asia.

The paper is organized as follows. In Section II, we conduct an overview of existing studies. In Section III, we explain FDI flows and characteristics in three types of FDI: North–North, North–South, and South–South FDI flow. Then, we provide a general description of the data we employed in Section IV. This section also explains how we can obtain data. In Section V, we assess the role of FDI in technology spillover, providing empirical models to estimate the effects of FDI. Section VI comprises a final summary and our conclusions.

II. Literature Review

The channel of international technology diffusion can be classified broadly into two categories, trade and FDI. Trade has been focused on as a major source of technology spillover for a long time. The routine of absorbing technology can be either imports or exports. However, a few researchers have found exports to be a path for technology transfer. This is because most studies were unable to find clear-cut evidence of so-called "learning-by-exporting" effects (Clerides, Lach, and Tybout 1998; Bernard and Jensen 1999; Hallward-Driemeir, Iarossi, and Sokoloff 2002).

On the other hand, a number of papers have shown that imports can be a crucial channel for technology diffusion. Eaton and Kortum (2001 and 2002) established a structure of technology diffusion based on the Ricardian model. In Eaton and Kortum's model, trade provides access to foreign technologies as well as goods by augmenting the production possibility frontier. However, their model includes no technology spillover, as importers already pay a competitive price for the technologies embedded in foreign goods. Coe and Helpman (1995) employed R&D spillover regressions and determined that foreign

R&D activities augment the TFP of host countries. Pursuant to Keller's finding (1998) that a randomly generated R&D variable can readily replace the actual one, a number of authors have further developed international R&D spillover regressions. Some have commented on the role of capital goods trade (Xu and Wang 1999), as opposed to overall trade as in Coe and Helpman's study, but others have captured the indirect R&D spillover effects (Lumenga-Neso, Olarreaga, and Schiff 2001). To summarize, there is plenty of convincing evidence of technology spillover though trade, but the existing literature also leaves some questions open.

Studies on the economic effects of FDI often concentrate on the host economy, particularly on improvements in productivity. They assume that FDI has positive effects on productivity, not merely because it is a source of capital, but also because it is an important source of human capital augmentation, technology change, and spillovers of ideas across countries through MNEs (Grossman and Helpman 1995). There are two principal reasons underlying this argument. First, when MNEs invest in host countries, they bring with them advanced intangible assets that comprise their specific advantage and provide them with the power to compete successfully with local firms that have superior information on local markets, consumer preferences, and local business practices. Thus, advanced intangible assets allow higher productivity to MNEs, thus outweighing the disadvantages they face in the domestic markets of host countries.

Second, the entry of MNEs disrupts the existing equilibrium and eliminates the monopolistic power of local firms in order to protect and maintain their market share. On the other hand, through direct contact with MNEs, local firms observe and imitate the operational protocols of MNEs. This suggests that competition, demonstration, and learning by doing among MNEs and local firms may lead to increases in productivity (Buckly and Casson 1976; Hymer 1976; Dunning 1993; Blomström and Kokko 1996; Caves 1996). Owing to these effects, many countries offer special incentives to foreign enterprises, including lower income taxes or income tax holidays, as well as import duty exemptions.

In theory, MNEs contribute to (i) improving efficiency and enhancing growth by breaking bottlenecks to investment, although this effect may become less important as the technology of the host country advances; (ii) introducing and applying new know-how by demonstrating new products production, marketing techniques (demonstration effects), and the training workers who later take employment in local firms, thus decreasing training cost (training effects); (iii) transferring techniques for inventory and quality control and standardization to their local suppliers and distribution channels; and (iv) forcing local firms to increase their managerial efforts, or to adopting some of the marketing techniques used by MNEs, either on the local market or internationally.

Empirical studies conducted thus far into the relevant effects of FDI on output or productivity have not been able to provide a definite conclusion, however, as results

vary depending on samples and econometric methodologies.[3] At the same time, these mixed empirical findings have raised another contentious issue with regard to whether a host government's provision of favorable benefits to induce FDI is justifiable. Aitken and Harrison (1999) determined that FDI negatively affects the productivity of domestically owned plants in Venezuela. Haddad and Harrison (1993) and Djankov and Hoekman (2000) detected no significant effects of foreign presence on the rate of productivity of local firms, i.e., there are no spillover effects. On the other hand, Haskel, Pereira, and Slaughter (2007) and Görg and Strobl (2002) found positive spillovers from foreign to local firms in the United Kingdom (UK) and Ireland, respectively. Additionally, studies by Caves (1974), Blomström and Wolff (1994), and Haskel, Pereira, and Slaughter (2007) demonstrate that foreign presence, in terms of the foreign share of employment or value added, tends to increase labor productivity among local firms.

Further, only a few empirical studies have considered the different effects of FDI spillover by different home countries. If technology spillover by FDI is the result of advanced intangible assets, these spillover effects might also rely on the differing characteristics of home countries. Moreover, other previous studies have focused solely on the US as a host country, and thus yield ungeneralizable findings. Therefore, FDI spillover effects will vary depending on the host and home countries; this is the principal hypothesis of this paper.

Since it is impossible to consider every single case to analyze FDI spillovers, it is necessary to categorize the type of host and home country. The countries are grouped into North versus South according to the income level of each country. In our study, we group OECD countries into the North and non-OECD countries into the South. In such a fashion, we are able to distinguish the type of FDI into three categories: North–North, North–South, and South–South FDI. In this paper, we explicitly differentiate the effects of FDI in three different categories. In particular, we focus on South–South FDI flows.

The technology transfer associated with North–North FDI flows in two directions. The first involves MNEs subsidiaries diffusing technologies to domestic firms in host countries (inward FDI technology transfer), and the other involves MNEs subsidiaries benefiting from local firms in the host country (outward FDI technology sourcing). Many researchers focus on comparisons between inward and outward FDI (Globerman, Kokko, and Sjöholm 2000; Branstetter 2001; van Pottelsberghe de la Potterie and Lichtenberg 2001; Singh 2003). Branstetter (2001) found evidence to suggest that both types of FDI spillover effects exist, whereas Globerman, Kokko, and Sjöholm (2000) found only evidence for the outward FDI effect. Singh (2003) and van Pottelsberghe de la Potterie and Lichtenberg (2001) have argued that the technology sourcing effect is much stronger than the technology transfer effect, using a sample of 10 countries of the Organisation for Economic Co-operation and Development (OECD).

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[3]   See Barba Navaretti and Venables (2004) and Görg and Greenway (2004) for surveys of spillover channels and empirical findings.

Other studies strictly cover technology sourcing practices, usually with a focus on the absorption of technologies from highly developed countries. The representative case is Japanese FDI in the United States (US) and Europe (Kogut and Chang 1991, Yamawaki 1993, Branstetter 2001). It turns out that Japanese firms enter the US and Europe market by establishing joint ventures with local firms if they have technological disadvantages. On the other hand, when Japanese firms have technological disadvantages relative to the US and Europe, they tend to build up new plants.

The spillover effects of North–South FDI are quite plausible, as a number of studies agree that less productive firms benefit more from foreign technology (Girma and Wakelin 2001; Griffith, Redding, and Simpson 2003; Haskel, Pereira, and Slaughter 2007). Inward FDI in the People's Republic of China (PRC) is the center of research attention (Coe, Helpman, and Hoffmaister 1997; Li, Liu, and Parker 2001; Liu et al. 2001; Wei and Liu 2001; Buckley, Clegg, and Wang 2002; Hu and Jefferson 2002; Liu 2002; Huang 2004). The common factor in these studies is that the absorption capacity of the host country performs a critical role in the efficacy of FDI spillover. This underlines the importance of human capital accumulation in the host country (Eaton and Kortum 1996; Xu 2000; Caselli and Coleman 2001).

Most studies into this general field of inquiry focus on North–North or North–South flows. However, research into South–South FDI spillover is quite rare. The closest study to this one is the study conducted by Schiff and Wang (2008). They estimated the effect of trade-related R&D on technology diffusion in North–South and South–South patterns of trade. They concluded that the magnitude and velocity of technology diffusion in the host country was much better via the North–South direction than through South–South trade. However, this research did not cover the role of FDI in technology spillover. As far as we know, no literature has addressed South–South FDI spillover, although FDI flow between countries considered to belong to the South is increasing steadily. Moreover, due to rapid economic integration and the construction of global networks in Asia, the magnitude of South–South FDI flows is expected to become increasingly larger. Therefore, South–South FDI should be also considered as well as North–North and North–South FDI in terms of its growing concern and importance. The type of technology spillover is summarized in Table 1.

Table 1: Summary of Literature

		Host Country	
		North	**South**
Home country	North	• Expected Technology Spillover Channel: − Importing intermediate inputs − Learning by doing − Inward technology transfer − Outward FDI sourcing • Existing Studies: − Clerides, Lach, and Tybout (1998) There is no significant effect from past exporting experience on reducing current cost. − Branstetter (2001) By the investigation of Japanese FDI in the US, they found that both types of FDI spillover exists. − Eaton and Kortum (2001 and 2002) There is no technology spillover from imports because of competitive price of intermediate input. − Singh (2003) Outward FDI sourcing effect is stronger than Inward technology transfer effect.	• Expected Technology Spillover Channel: − Importing intermediate inputs − Learning externalities − Human capital accumulation − R&D spillover • Existing Studies: − Coe and Helpman (1995) Foreign R&D activities augment total factor productivity of host countries through trade. − Coe, Helpman, and Hoffmaister (1997) Developing countries benefit more from foreign technology if the transfer is processed by a more skilled labor force. − Liu et al. (2001) FDI has positive effects on labor productivity in the PRC electronic industry.

		Host Country	
		North	**South**
Home country	South	• No literature exists.	• Expected Technology Spillover Channel: − Importing intermediate input − Local hire • Existing Studies: − Wells (1983) Local-hire policy gives domestic skilled labor chances to acquire knowledge and know-how. − Schiff and Wang (2008) South–South FDI is effective for increasing domestic productivity, but North–North FDI is much more effective than South–South FDI.

Source: Authors' compilation.

To categorize the various forms of FDI by host and home countries and figure out the differences among them, the pattern of technology spillover in FDI and its impact on growth are considered. The succeeding sections will focus on the effects of South–South FDI flows and determine the distinctive features that differentiate North–North and North–South FDI.

III. Pattern of FDI Flows: An Initial Look

This section examines stylized trends of FDI flows in North–North, North–South, and South–South. Some OECD countries[4] such as France, Germany, and the US comprise the North countries[5] while all non-North countries comprise the South. We use FDI data from the OECD FDI Statistics and UNCTAD FDI dataset. Hence, we can obtain only North–North and North–South FDI data, because of existing bilateral FDI data between OECD member countries and the world countries in OECD. We obtained South–South FDI data via mergers with the UNCTAD FDI dataset. We also classify the Asian countries[6] in order to identify key trends of FDI flows in this region (see Appendix).

Figure 1 shows FDI flows for the world from 1985. World FDI stepped up considerably in the middle of the 1980s; from that time on, FDI continued to grow in the 2000s. The early 2000s and recent years have been the only exception to the general increases, as the information technology bubble collapsed and the world economy became embroiled in the financial crisis. Note that the PRC and other Asian countries have taken the lead in recent FDI flows.

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[4] According to *OECD.Stat*, the OECD countries are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, the Republic of Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the UK, and the US.

[5] In this paper, the North countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the UK, and the US.

[6] In this paper, the (developing) Asian countries are Bangladesh; the PRC; Hong Kong, China; India; Indonesia; the Republic of Korea; Malaysia; Pakistan; the Philippines; Singapore; Sri Lanka; Thailand; and Viet Nam.
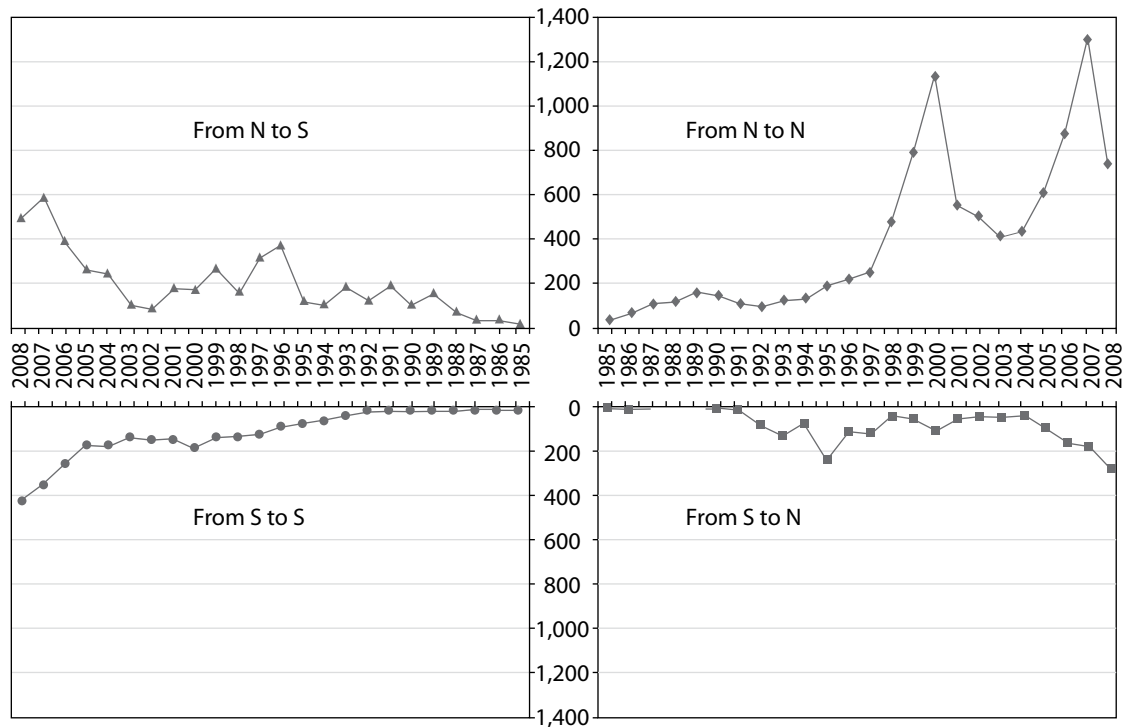
Figure 1: World FDI Flows (US$ billion)
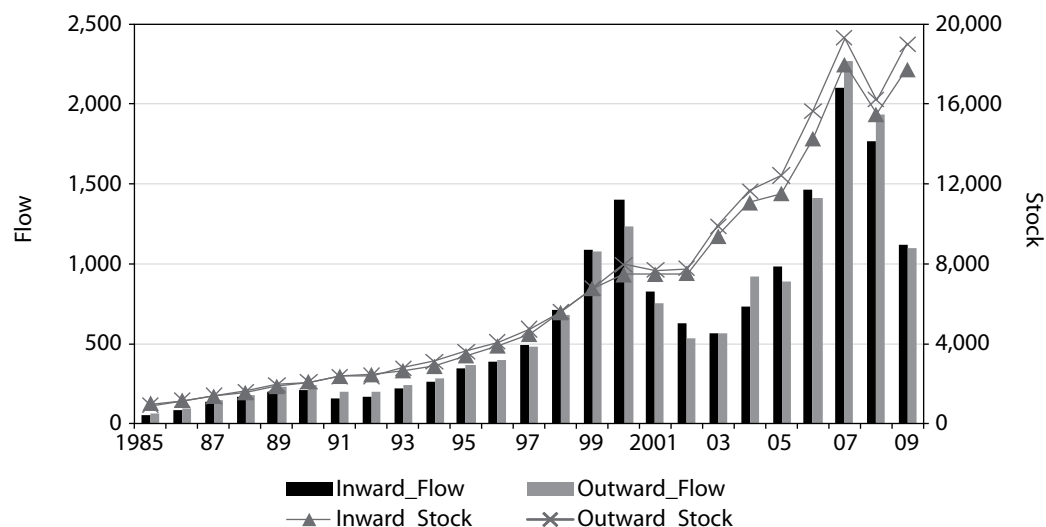
Source: Authors' calculations based on the UNCTADSTAT. http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

Figure 2 illustrates FDI flows by income level of home and host countries. Each quadrant shows a different source and recipient country. For example, the first quadrant represents FDI flows from North to North countries. As anticipated, it turns out that North countries have a large share of FDI into their *own* countries (North countries). Table 2 shows the share of FDI across North countries from 1985 to 2008. In all years, both inward and outward FDI between North countries accounted for up to 70% of the total. This is quite consistent with the existing literature. That is, a number of influential papers have suggested that the bulk of FDI is essentially horizontal direct investment among countries with similar per capita incomes or similar relative factor endowments. In other words, market-seeking FDI pattern is the dominant variety (see Markusen 1995 and Brainard 1993).[7] Also, it is worth noting that the US, Belgium, and the UK have ranked the highest among source and recipient countries by investing in other North countries. In terms of size, those three countries' pivotal role is hardly comparable to that of other countries (see Figure 3).

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[7] Markusen (1995) reports that in 1985, developed countries were the source of 97% of direct investment flows and the recipient of 75%. He also notes that the share of all direct investment outflows generated by G-5 countries absorbed by other G-5 countries has been rising, and amounted to 70% of the total by 1988.
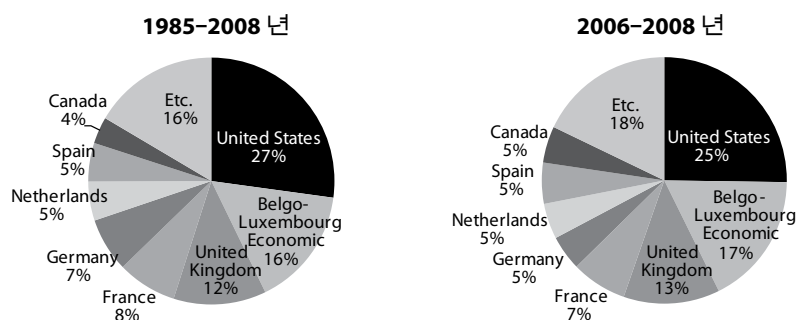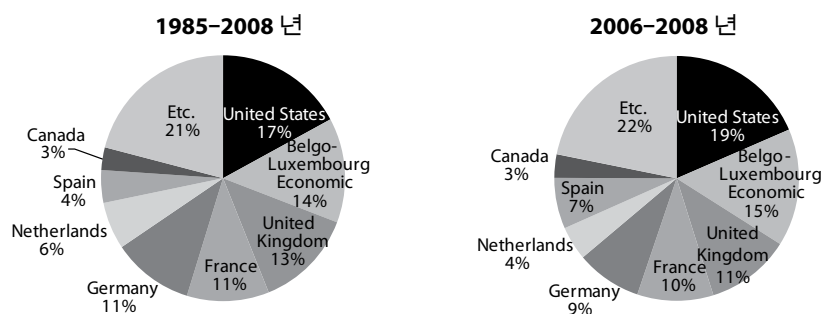
Figure 2: FDI Flows by Income Level of Home and Host Countries (US$ billion)

Source: Authors' calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

Table 2: Share of FDI between North Countries (percent)

		1985	1990	1995	2000	2005	2006	2007	2008
Flow	Inward	61.99	69.08	54.18	80.80	61.73	59.71	61.81	41.49
	Outward	75.77	82.66	77.13	86.61	66.40	59.06	63.60	60.70
Stock	Inward	32.35	52.60	48.41	45.33	52.85	51.71	49.96	54.47
	Outward	38.11	59.15	48.85	47.91	52.70	50.20	48.92	58.05

Source: Authors' calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

Figure 3: Share of Major Countries in FDI between North Countries

(a) Inward FDI

1985–2008 년

Canada 4%
Etc. 16%
United States 27%
Spain 5%
Netherlands 5%
Germany 7%
France 8%
United Kingdom 12%
Belgo-Luxembourg Economic 16%

2006–2008 년

Etc. 18%
Canada 5%
United States 25%
Spain 5%
Netherlands 5%
Germany 5%
France 7%
United Kingdom 13%
Belgo-Luxembourg Economic 17%

(b) Outward FDI

1985–2008 년

Etc. 21%
United States 17%
Canada 3%
Spain 4%
Netherlands 6%
Germany 11%
France 11%
United Kingdom 13%
Belgo-Luxembourg Economic 14%

2006–2008 년

Etc. 22%
United States 19%
Canada 3%
Spain 7%
Netherlands 4%
Germany 9%
France 10%
United Kingdom 11%
Belgo-Luxembourg Economic 15%

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat. unctad.org/ReportFolders/reportFolders.aspx

In recent years, however, we have observed increasing FDI flows involving developing countries as either the source or destination markets. In 1985, South countries were the recipient of only 3% of total world outward FDI, but inward FDI in these countries has increased dramatically over time. As of 2008, almost half of FDI goes into South countries. In particular, since 1985, inward FDI to Asian developing countries (such as the PRC; Hong Kong, China; and India) has risen dramatically. We can see this in Figure 4. This pattern is quite similar to the outward FDI from developing countries (Figure 5).

Figure 4: Inward FDI to Developing Countries and Asian Countries (US$ billion, %)
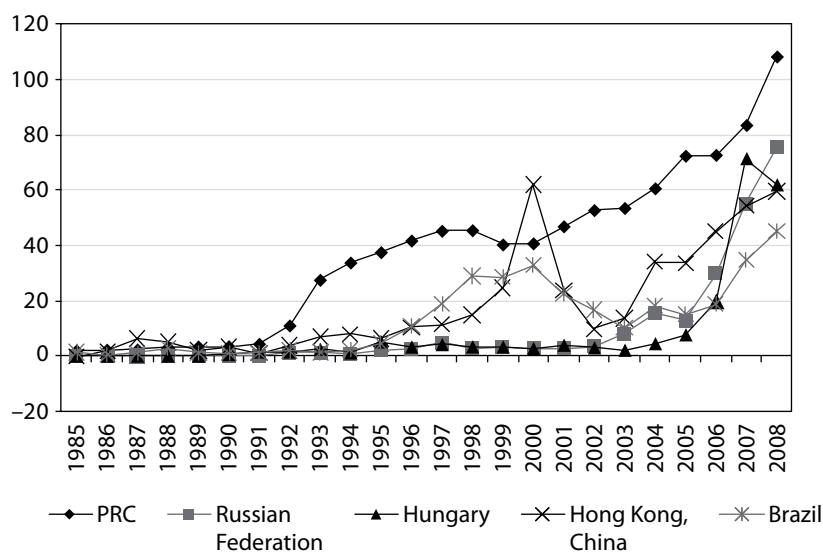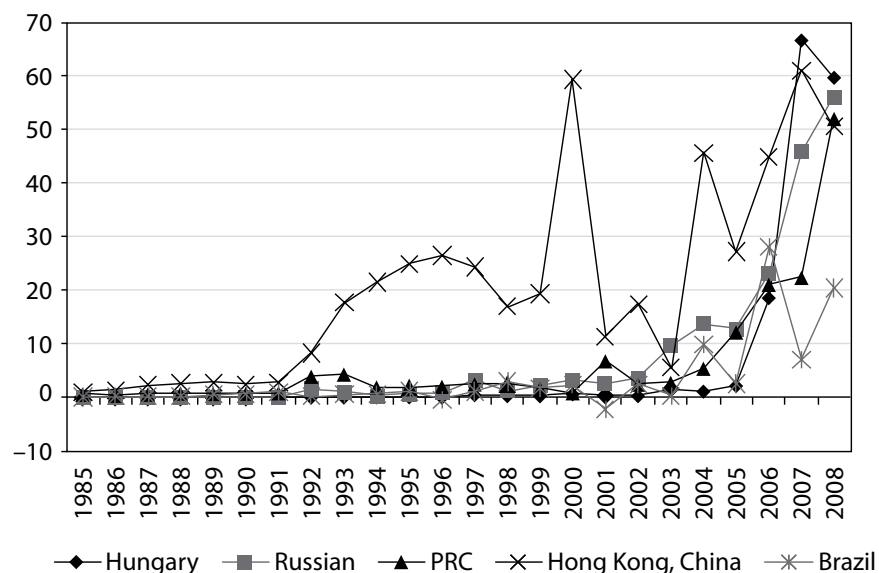

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
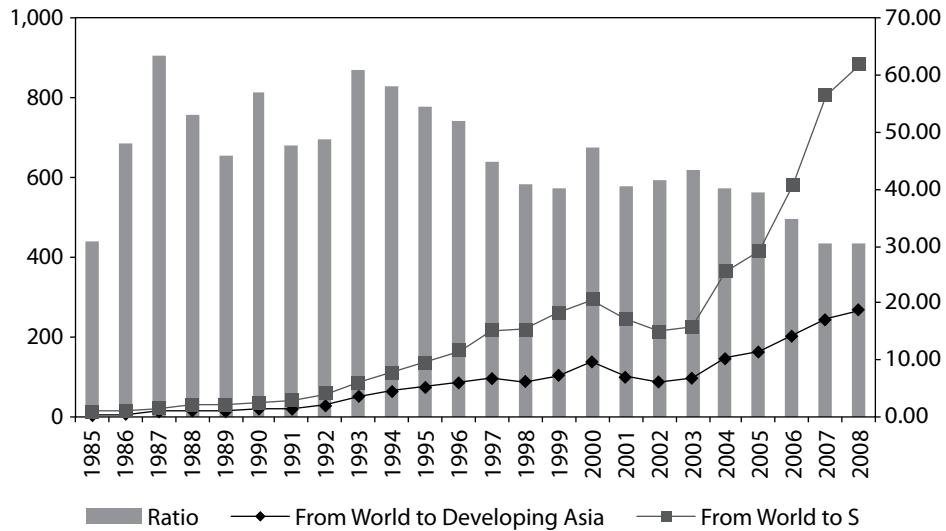
Figure 5: Outward FDI from Developing Countries and Asian Countries (US$ billion, %)

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
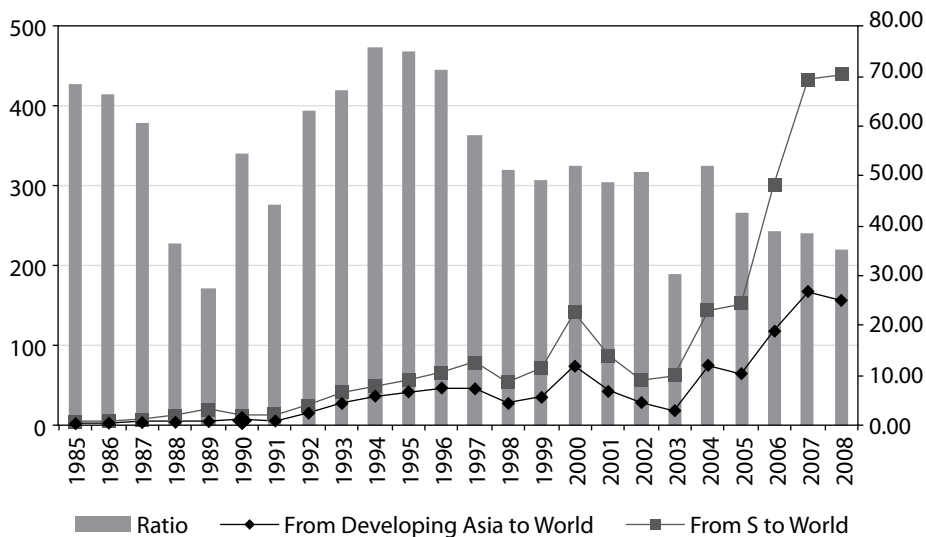
In addition, based on their high shares of FDI in terms of inward and outward FDI, the PRC; the Russian Federation; Hong Kong, China; Brazil; and India are considered the major five developing countries. As indicated in Figure 6, the importance of these developing countries as destination markets increased significantly over time. As a consequence, inward FDI flows between developing countries increased from 14.7% in 1985 to 18.1% in 2008. In particular, the PRC makes up the largest inward FDI amount, with $110 billion. This suggests how the supply of cheap labor in the PRC is almost certainly a comparative advantage in terms of FDI. World multinational firms investing in labor-intensive industries of low-income countries (developing countries) have more incentive to exploit cheap wages in the region than do other firms that produce nonlabor-intensive products.

Additionally, these developing countries perform a key role in terms of FDI source countries (see Figure 7). For example, the Russian Federation invested $56 billion in different countries in 2008. Of this total, only 1% ($0.8 billion) was invested into North countries, whereas 99% was invested into other developing countries. Like the Russian Federation, other major developing countries, such as Brazil and India, have very similar patterns of FDI in recent years.

Figure 6: Inward FDI to Five Major Recipient Developing Countries (US$ billion)

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx
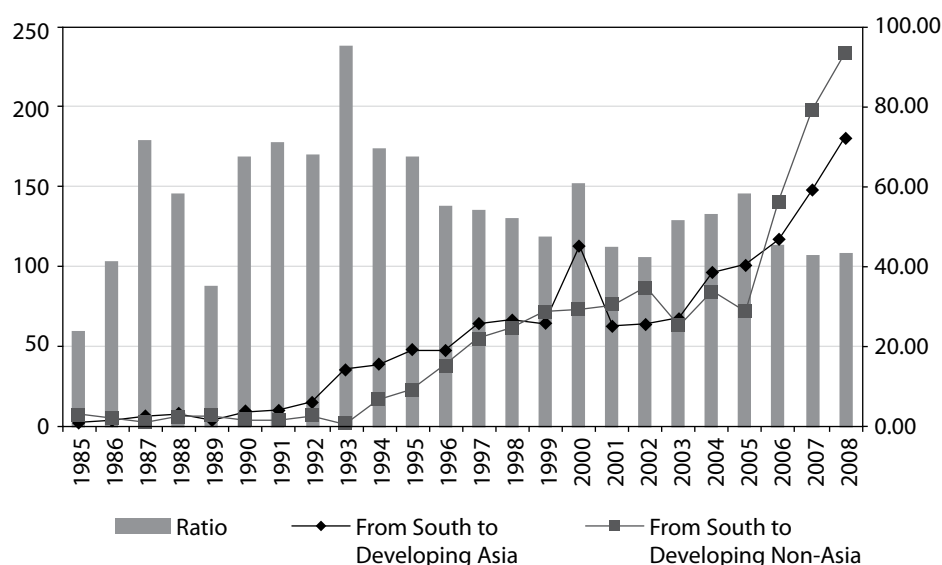
Figure 7: Outward FDI from Five Major Sending Developing Countries (US$ billion)

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

It is noteworthy that Asian developing countries have a higher share of both inward and outward FDI in South–South FDI flows. As can be clearly observed in Figure 8, Asian developing countries make up a higher share than non-Asian countries in South–South FDI in all years. In terms of inward FDI, the major recipient Asian developing countries are the PRC, India, and the Republic of Korea.

Figure 8: FDI between South–South: Asia / Non-Asia (US$ billion, %)

(a) Inward FDI
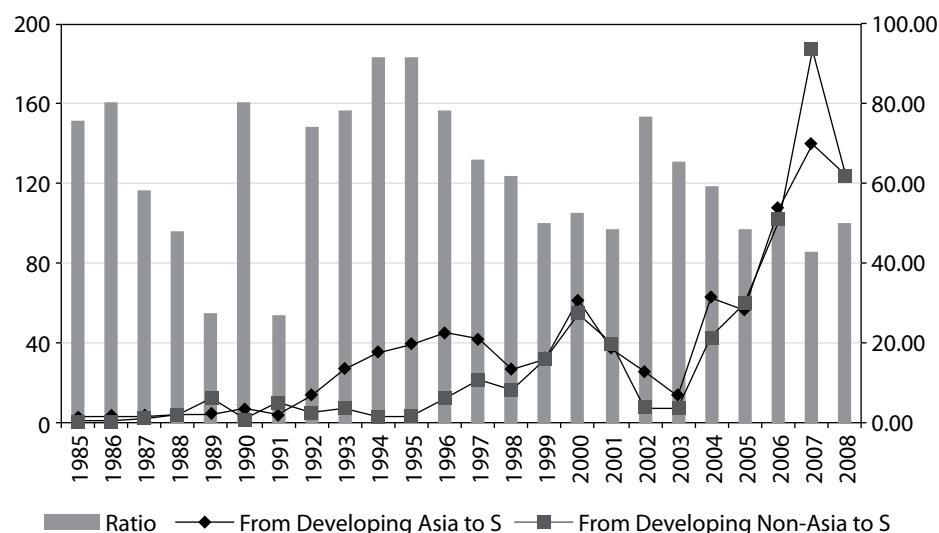

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx

continued.

Figure 8: *continued.*

(b) Outward FDI

Source: Author's calculations based on the OECD.stat http://stats.oecd.org/index.aspx?r=772795 and UNCTADSTAT http://unctadstat.
unctad.org/ReportFolders/reportFolders.aspx

It is also worth mentioning that there was no significant FDI between the PRC and the Republic of Korea until the two countries established official diplomatic relations in 1992. Immediately after the two countries normalized their diplomatic relations, bilateral FDI volumes began to increase rapidly. As a consequence, total FDI into the PRC was only $9.5 billion in 1992; from that time on, FDI increased dramatically, accounting for $24.6 billion in 1993. Since then the Republic of Korea has emerged rapidly as a source, and the PRC has been the main destination country of Korean FDI in developing countries, receiving approximately 50% of total investment (see Figures 9 and 10).

Figure 9: Republic of Korea's Outward FDI (US$ billion)
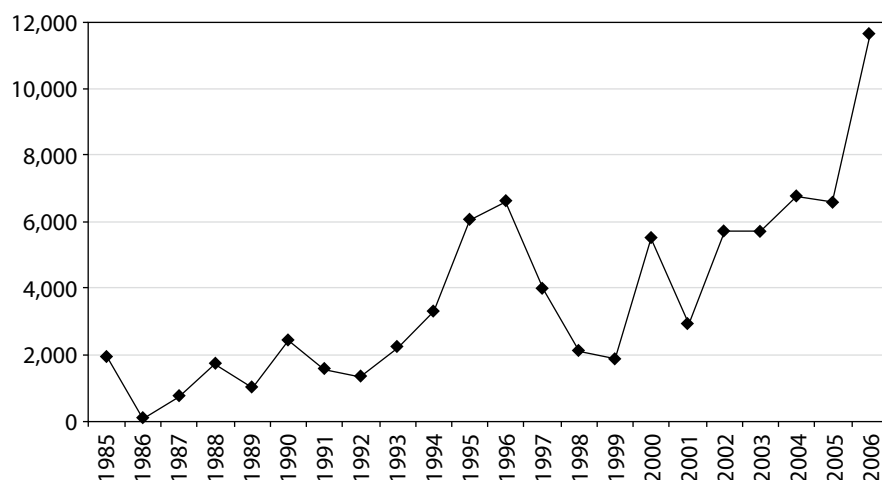
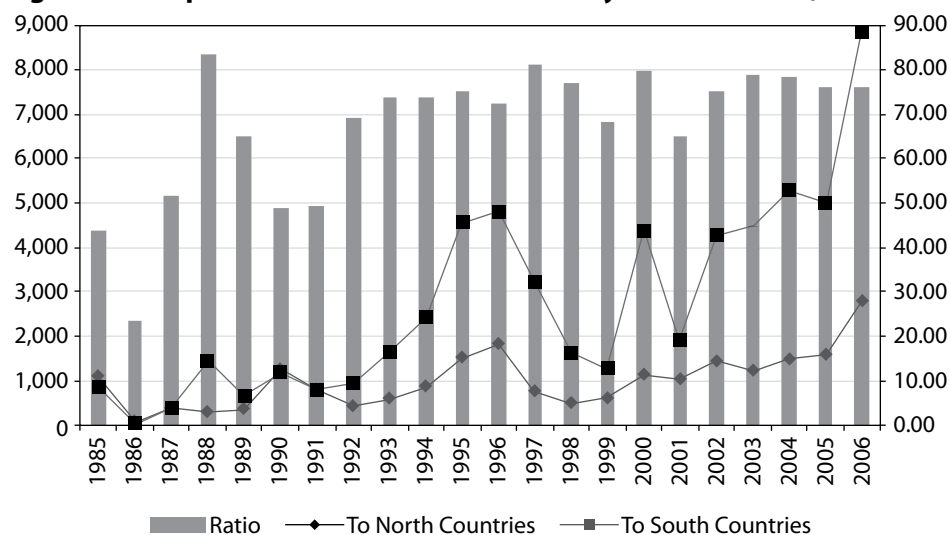Source: Export-Import Bank of Korea. http://keri.koreaexim.go.kr/05_invest/01_statistics/investTotal_year.jsp

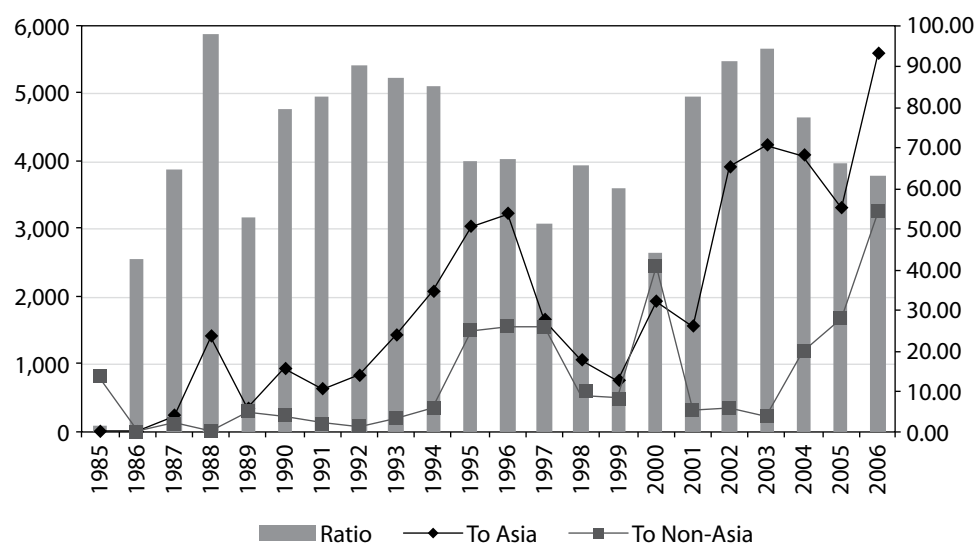**Figure 10: Republic of Korea's Outward FDI from Five Major Developing Countries (US$ billion)**
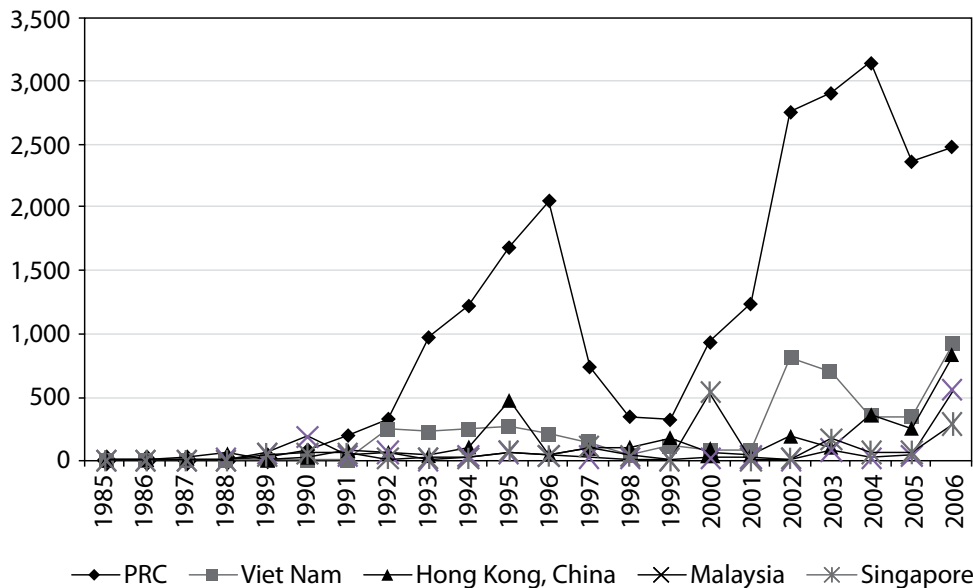
Source: Export-Import Bank of Korea. http://keri.koreaexim.go.kr/05_invest/01_statistics/investTotal_year.jsp

More recently, firms in the Republic of Korea have increasingly used outward FDI as a strategic tool to strengthen their international competitiveness. This transformation has been prompted by recent trends of rapidly rising nominal wages and more frequent labor–management conflicts in the country. Firms have responded by moving their production facilities abroad to maintain their international competitiveness. The government has also recognized the strategic role of outward FDI in strengthening competitiveness abroad, by liberalizing its policy regimes as well as providing financing and other incentives.

At the same time, as can be seen in Figure 11, a major portion of Korean FDI shifted from natural resource industries to manufacturing industries, and from investment in developed countries (North) to investment in other developing countries (South). In particular, Korean firms sunk FDI into other developing Asian countries, primarily to enter local markets, as well as to establish supply bases serving markets in other countries including the Republic of Korea; that is, to supply goods to world markets by taking advantage of cheap labor in developing Asian countries. With regard to Korean FDI into South countries, as seen in Figure 12, approximately 75% of Korean investment was concentrated on developing Asian countries and only 25% of investment occurred in developing non-Asian countries. This pattern illustrates that Korean multinationals engage more heavily in developing Asian countries than in non-Asian low-income countries.

Figure 11: Republic of Korea's Outward FDI by Income Level (US$ billion, percent)

Source: Author's calculations based on the Export-Import Bank of Korea. http://keri.koreaexim.go.kr/05_invest/01_statistics/
investTotal_year.jsp

Figure 12: Republic of Korea's Outward FDI to Developing Asian and Non-Asian Countries (US$ billion, percent)

Source: Author's calculations based on the Export-Import Bank of Korea. http://keri.koreaexim.go.kr/05_invest/01_statistics/
investTotal_year.jsp

In addition, India as a recipient of FDI in this region has begun to perform a crucial role in recent years, whereas FDI into Singapore and Taipei,China has decreased. In particular, it is interesting to note that FDI from South countries into Singapore has declined significantly, reflecting that the destination was moved from Singapore to the PRC and India.

On the other hand, in regard to outward FDI, developing Asian countries, such as the PRC, India, Indonesia, and Malaysia, invest in other Asian developing countries. In particular, the PRC is the main source country of FDI in this region.

IV. Data and Summary Statistics

The primary source of data for this study was the OECD FDI Statistics. This dataset provides data on bilateral FDI flows not only between OECD countries, but also between OECD and non-OECD countries. However, this dataset does not contain information regarding South–South FDI flows. The second source of data is the UNCTAD FDI dataset. This dataset does not contain information specifically regarding bilateral FDI flows, but does list total inbound or outbound FDI by country. Therefore, in order to derive the South–South FDI information, we merged the OECD dataset with the data from UNCTAD.

Our sample contains 122 countries over the whole 1989–2008 period, with 22 countries classified as developed countries.[8] The data for each country, including gross domestic product (GDP) and per capita GDP, was obtained from the World Bank dataset. As for total factor productivity (TFP), as is well known, accurately measuring multifactor productivity is quite difficult. In this paper, we obtained TFP growth statistics provided by the Asian Development Bank. To deflate the value of FDI, we used the US GDP deflator, and to deflate each country's data, we used each country's GDP deflator for every year.

Table 3 includes a list of variables through which we captured the growth of TFP, FDI flows, and imports. In the table, we can see that the average growth of TFP is 0.9%. Additionally, FDI from North countries is larger than from South countries in our sample.

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[8]   The merged dataset contains 215 countries, but there are many missing values for items such as TFP and inbound FDI stock. Therefore, we ended up with a total of 122 countries.

Table 3: Summary Statistics

| Variable	Mean	Std. Dev.	Min	Max	Obs.
TFP growth (ADB provided)	0.009	0.121	−1.499	0.986	764
ΔLog(FDI stock from W)	0.427	0.633	−3.696	7.902	1,058
ΔLog(FDI stock from N)	0.540	1.204	−4.691	7.431	818
ΔLog(FDI stock from S)	0.397	0.970	−6.358	10.701	950
ΔLog(Imports from W)	0.222	0.287	−1.128	1.262	674
ΔLog(Imports from N)	0.167	0.345	−1.359	2.252	674
ΔLog(Imports from S)	0.299	0.408	−5.134	4.068	674

Source: Authors' calculations.

Prior to the empirical test, we assessed the relationship of FDI or imports with TFP. To accomplish this, we constructed the new panel data after 3-year differencing. Since our data spanned the years 1989–2008, a panel set of cross-country data was established over six 3-year periods from 1989 to 2007, corresponding to the intervals 1989–1992, 1992–1995, 1995–1998, 1998–2001, 2001–2004, and 2004–2007.[9] Figure 13 shows the patterns of TFP growth and FDI over time. For instance, the data points in 2001 represent the TFP growth and inward FDI stock growth over 1998–2001. At first glance, it is difficult to tell whether the two patterns co-move. We also show the FDI inflow from North and South. It is also difficult to tell whether either pattern moves closely with TFP growth.

Broken down by country (developed countries [DCs], less developed countries [LDCs], and Asian developing countries [ADCs]) it is still somewhat difficult to assess definitively the relationship between FDI and TFP growth. At best, the co-movement appears more likely in the case of LDCs (panel C) than DCs (panel B). If there are FDI externalities in North–North, we should be able to capture the effect as in panel B, particularly between TFP growth and FDI_N. The findings do not seem to support this hypothesis, however. Also, if there exist spillover effects in North–South, TFP growth and FDI_N in panel C should appear to be related. The findings also do not appear to support this hypothesis. Panel D shows the patterns in Asian developing countries (ADCs). Again, it is difficult to discern the co-movement between the variables in a definitive way. Note, however, that this average pattern does not control for country-specific and year-specific effects. The real effect is assessed via econometric tools in the following section.

Co-movement is more prevalent on the imports side. Figure 14 shows the patterns of imports and TFP growth. For instance, the data point of imports in 2001 represents the changes of imports over 1998–2001. As one can readily see, TFP growth and imports move closely with one another. Moreover, this co-movement is more likely between the imports from DCs than LDCs. The co-movement in developing Asian countries appears to be quite strong. In particular, the Asian financial crisis in 1998 hit imports as well as TFP.

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[9] We dropped the 2008 data due to the financial crisis shock. The negative shock in 2008 was so severe that including the 2008 shock would not produce economically meaningful implications in terms of the long-run relationship between inbound FDI and TFP growth.

Figure 13: TFP Growth versus Inward FDI (%)
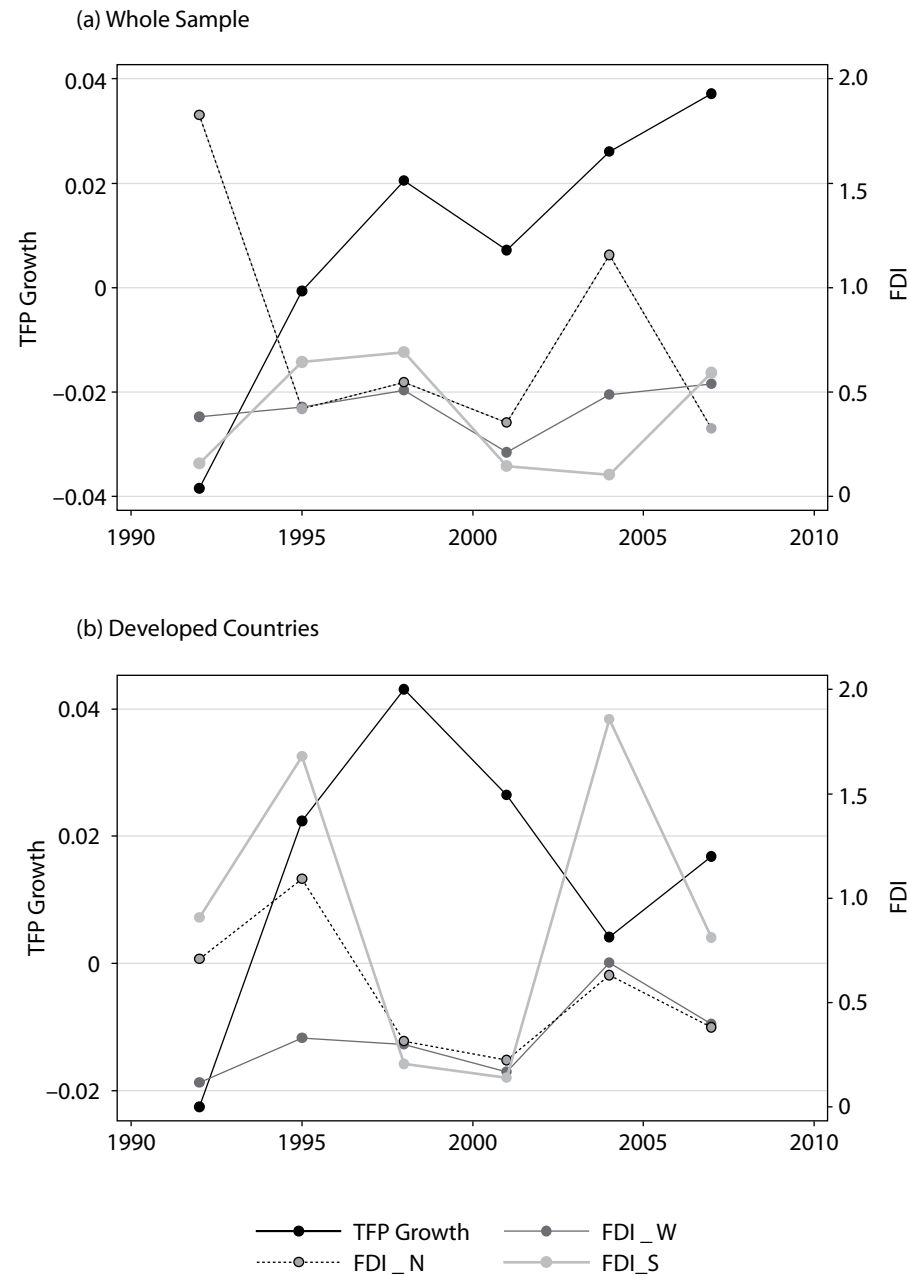
(a) Whole Sample

(b) Developed Countries

FDI_N = foreign direct investment from the North, FDI_S = foreign direct investment from the South, FDI_W = foreign direct investment from the World.
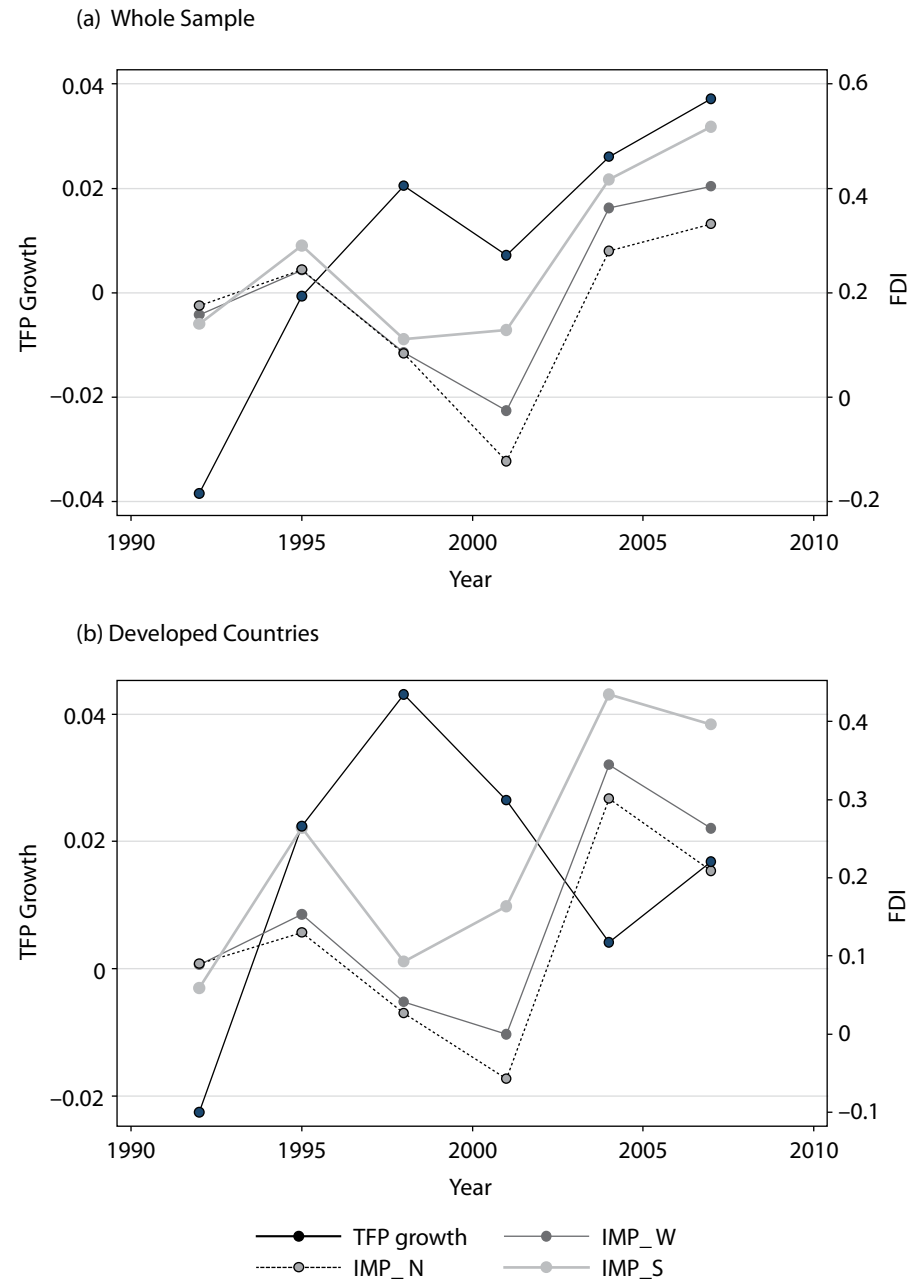Source: Authors' calculations.

continued.

Figure 13: *continued.*
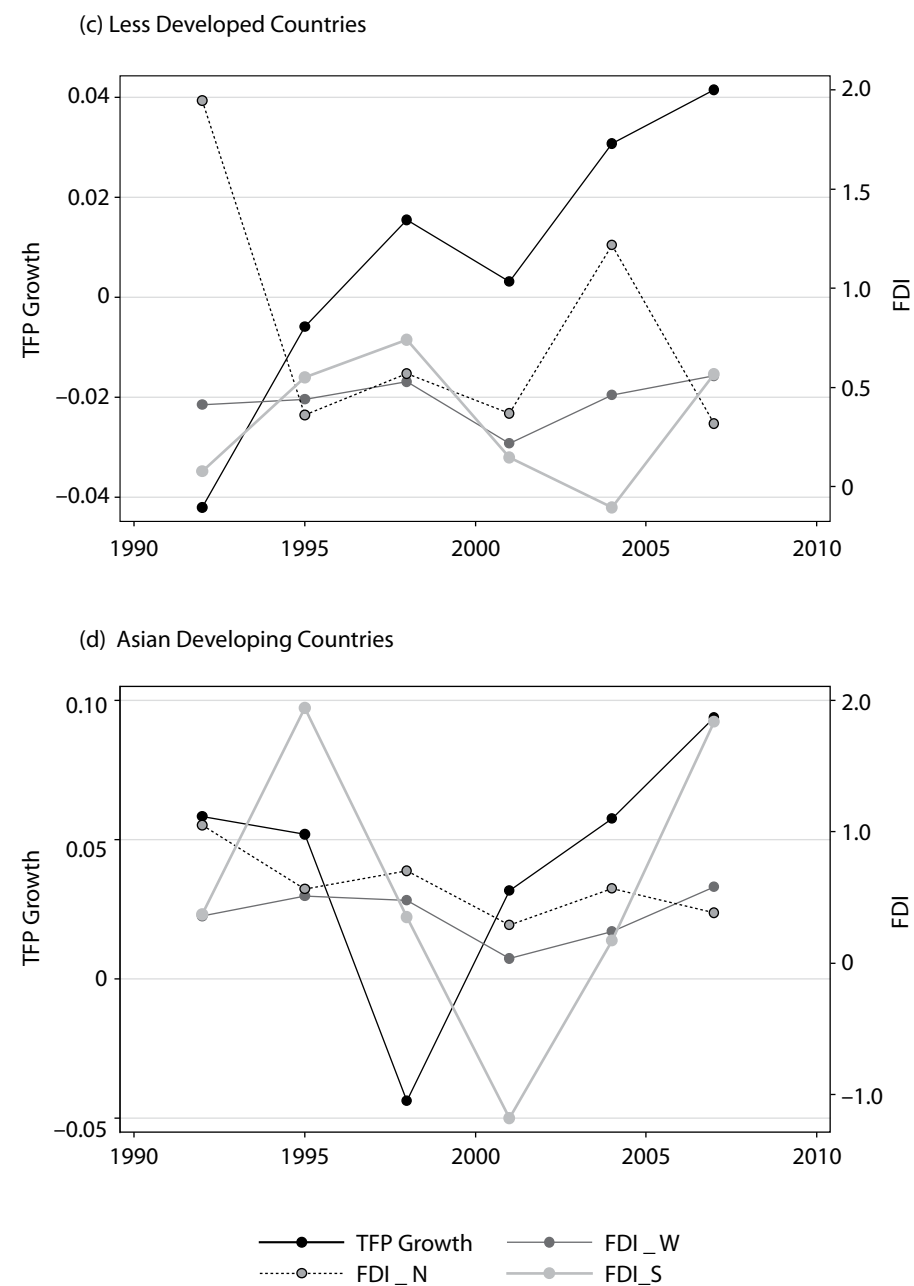
(c) Less Developed Countries

(d) Asian Developing Countries

FDI_N = foreign direct investment from the North, FDI_S = foreign direct investment from the South, FDI_W = foreign direct investment from the World.
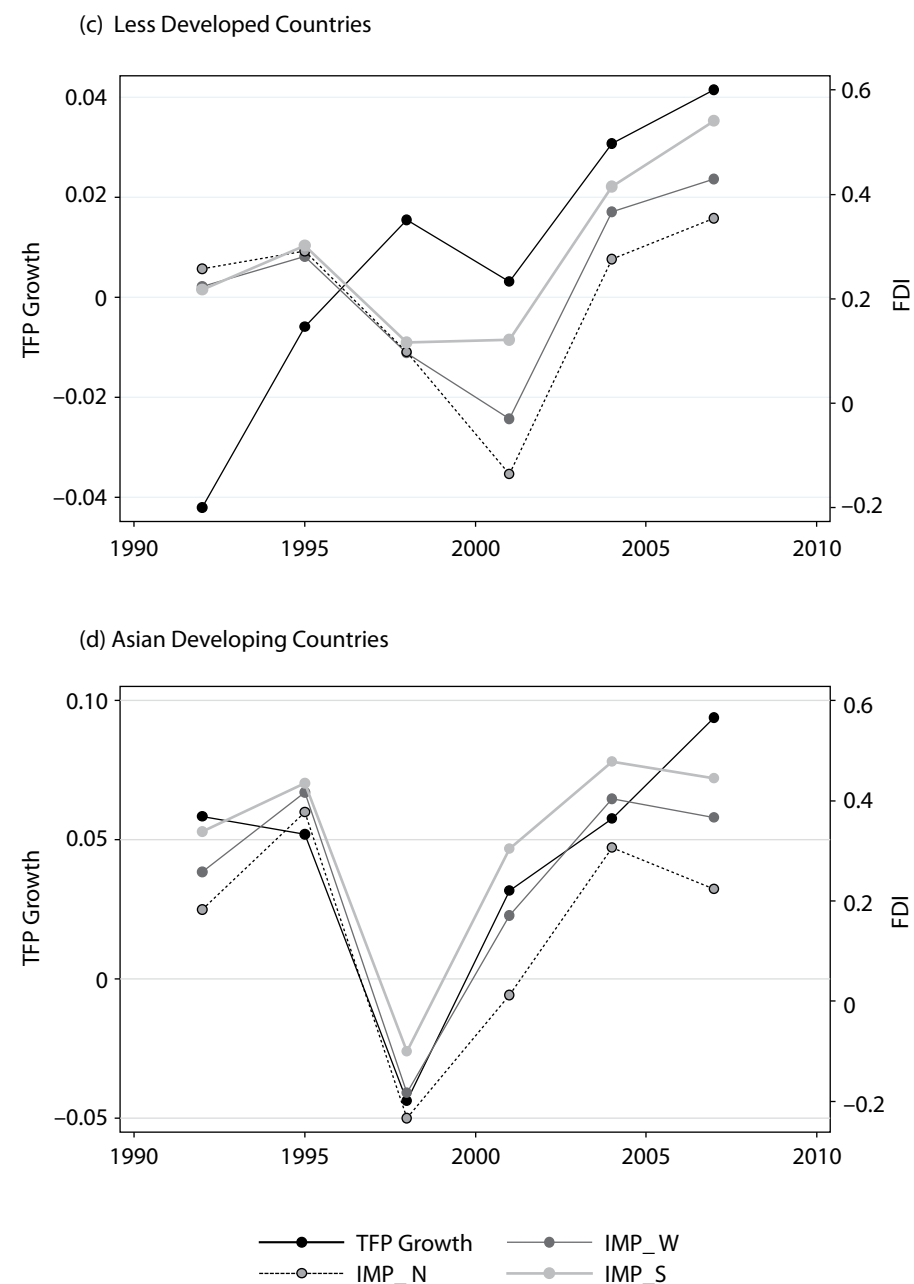Source: Authors' calculations.

Figure 14: TFP Growth versus Imports (%)

(a) Whole Sample

(b) Developed Countries

FDI_N = foreign direct investment from the North, FDI_S = foreign direct investment from the South, FDI_W = foreign direct investment from the World.
Source: Authors' calculations.

continued.

Figure 14: *continued.*

(c) Less Developed Countries

(d) Asian Developing Countries

FDI_N = foreign direct investment from the North, FDI_S = foreign direct investment from the South, FDI_W = foreign direct investment from the World.
Source: Authors' calculations.

We compute the simple correlation between variables in Table 4. This table appears to tell a different story from the figures. TFP growth is related significantly with FDI as well as imports. TFP growth and FDI are closely related in all cases except for developing

Asian countries. These conflicting patterns should be investigated further via econometric research. In the next section, we econometrically assess the relationship after controlling time- and country-specific effects.

Table 4: Correlation between TFP Growth, FDI, and Imports

TFP Growth	Total	DCs	LDCs	ADCs
ΔLog(FDI stock from W)	0.0862*	0.2696*	0.0803*	0.1065
ΔLog(FDI stock from N)	0.0763*	0.1719*	0.0750*	−0.2541*
ΔLog(FDI stock from S)	0.1028*	0.3892*	0.0853*	0.2838*
ΔLog(Imports from W)	0.3075*	0.1176	0.3162*	0.6552*
ΔLog(Imports from N)	0.2555*	0.1276	0.2598*	0.5822*
ΔLog(Imports from S)	0.1974*	0.1249	0.1988*	0.6605*

* Significant at 10% level.
ADCs = Asian developing countries, DCs = developed countries, FDI = foreign direct investment, LDCs = less developed countries, TFP = total factor productivity.
Source: Authors' calculations.

V. Empirical Specification and Results

The baseline estimation equation is as follows.

$$\Delta Z_{it} = \alpha_1 + \alpha_2 \Delta FDI_{it} + \alpha_3 \Delta IMP_{it} + \omega_t + v_{it}, \tag{1}$$

where Z_{it} is a country i's performance such as TFP in year t, FDI represents the stock of FDI inflows into country i, and IMP imports. We add the time-specific effect, ω_t.[10]

Analysis using annual data has the benefit of many observations, but yearly noise might influence the regression results, even with year-specific dummy variables. Hence, as indicated, we construct new panel data after 3-year differencing. Since our data span the period 1989–2008, a panel set was established of cross-country data over six 3-year periods from 1989– 2007, corresponding to the intervals 1989–1992, 1992–1995, 1995– 1998,1998–2001, 2001–2004, and 2004–2007. Note that the analysis using differenced data does not require country-specific effects, since constant country-specific effects are removed by differencing. Some studies have used annual observations, but the high frequency variations in TFP are more likely to result from business fluctuations than from technological change. Others have used cross-sectional regressions with period-average data, but they are more likely subject to bias from omitted country-specific variables.

The variable of interest is α_2. If this variable is significantly positive, we take it as the FDI's positive spillover effect. Table 5 shows the results of this baseline equation. Each column in the group uses a different sample. The second column shows the results based on the whole sample. DCs in the third column represent recipient countries belonging

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[10] One may argue that the FDI measure should be divided by the country's GDP since the size of FDI relative to a country's economic size might matter for a country. The hypothesis we have in mind involves technology diffusion, however. As an extreme example, if a breakthrough technology is available through FDI, it will spill over across sectors and enhance the overall TFP, regardless of the size of the country.

to DCs. The fourth column focuses on LDCs. The analysis only on ADCs is in the fifth column.

The second column shows that there are significant positive impacts of FDI. We also find the positive impacts in imports. As for the magnitude, the impacts of the imports are relatively stronger than FDI. It is demonstrated that a 10% increase of FDI improves TFP by 0.2%. In the case of the imports, TFP is improved by 0.7% with a 10% increase in imports. When limiting the sample only to DCs, the impacts of FDI disappear. The imports still have positive impacts, however. In the case of LDCs, FDI is found to affect TFP. The finding of positive impacts in LDCs and not in DCs is consistent with previous literature. When focusing on Asian developing countries, the effects of FDI disappear. The results in the fifth column should be interpreted cautiously, however. As we saw in Figure 13, the Asian countries were embroiled in a financial crisis in 1998. The finding of no significant effects might derive from the negative shocks inherent to that specific year. One solution to this is to limit the data to after 1999, in which case, however, there are no sufficient observations to formally examine the relevant effects.

Table 5: Regression Results

	TFP			
	All	**DCs**	**LDCs**	**ADCs**
FDI	0.0218 **	0.00972	0.0288 **	0.0162
	(0.00935)	(0.0114)	(0.0113)	(0.0211)
Imports	0.0680 ***	0.0873 **	0.0633 ***	0.126 ***
	(0.0167)	(0.0365)	(0.0192)	(0.0417)
Observations	491	105	386	67
R-squared	0.091	0.368	0.096	0.512

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.
ADCs = Asian developing countries, DCs = developed countries, FDI = foreign direct investment, LDCs = less developed countries, TFP = total factor productivity.
Note: Standard errors in parentheses.
Source: Authors' estimates.

As indicated, we distinguish FDI sending countries' income level, FDI from DCs, and FDI from LDCs. The other possible channel of spillover effects, imports, is also distinguished by the income levels of the exporting countries.

Table 6 shows the results, some of which are noteworthy. The second column shows that the sending countries' income level is relevant. That is, FDI from DCs have significantly positive impacts on TFP, whereas FDI from LDCs does not. As for the imports, the income level also matters. Limiting the sample to DCs appears to produce some counter-intuitive results, however. The effects of FDI from DCs are negative and significant. One possible explanation for this is that FDI from DCs, rather than bringing advanced technologies, might affect a domestic country through intensive competition, such that good quality domestic firms are crowded out. Still, the imports from DCs do have a

The final exercise involves the absorptive capacity hypothesis. According to this hypothesis, a country should be sufficiently developed to absorb the externalities brought by the FDI or imports. Using the average educational attainment of countries as provided in Barro and Lee's database, we evaluate this hypothesis. We assume that higher educational attainment means that a country's human capital is sufficiently accumulated to absorb the positive externalities. The results are reported in Table 8. According to the table, the absorptive capacity matters for imports, not FDI. The interaction terms are significant mostly in the case of the imports, while they are not significant in terms of FDI.

Table 7: Instrument Variables Estimation Results

	TFP			
	All	**DCs**	**LDCs**	**ADCs**
FDI from North	0.0104 *	−0.00211	0.0136*	−0.00497
	(0.00574)	(0.00442)	(0.00770)	(0.0126)
FDI from South	0.00599	−0.00301	0.0104	0.0106
	(0.00471)	(0.00341)	(0.00733)	(0.00805)
Import from North	0.0576 ***	0.0750 **	0.0579 ***	0.0902 *
	(0.0149)	(0.0357)	(0.0167)	(0.0482)
Import from South	0.0220	0.0259	0.0224	0.0155
	(0.0169)	(0.0295)	(0.0191)	(0.0712)
Observations	455	85	370	60
R-squared	0.093	0.122	0.102	0.414

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.
ADCs = Asian developing countries, DCs = developed countries, FDI = foreign direct investment, LDCs = less developed countries, TFP = total factor productivity.
Note: Standard errors in parentheses. FDI variables are intrumented by one lag variable of FDI.
Source: Authors' estimates.

Table 8: Absorptive Capacity

	TFP			
	All	**DCs**	**LDCs**	**ADCs**
FDI	0.0417	0.225	0.0396	0.00709
	(0.0317)	(0.238)	(0.0358)	(0.0802)
Imports	−0.118 **	−0.371	−0.145 **	−0.118
	(0.0529)	(0.477)	(0.0595)	(0.137)
FDI*education	−0.0132	−0.0923	−0.00872	0.00876
	(0.0163)	(0.102)	(0.0191)	(0.0429)
Imports*education	0.105 ***	0.196	0.119 ***	0.134 *
	(0.0285)	(0.204)	(0.0324)	(0.0698)
Observations	491	105	386	67
R-squared	0.120	0.375	0.136	0.553

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.
ADCs = Asian developing countries, DCs = developed countries, FDI = foreign direct investment, LDCs = less developed countries, TFP = total factor productivity, .
Note: Standard errors in parentheses.
Source: Authors' estimates.

VI. Conclusions

The principal objective of this paper was to assess whether FDI exerts statistically significant effects on the host countries' economic performance, including in terms of TFP. These effects are frequently referred to as FDI externalities or spillover effects. This paper also attempts to assess whether these spillover effects depend on the sending countries' income level. There are some crucial questions that have been left unaddressed in previous literature; for example: To what extent can the role of FDI flows in spillovers be determined, and can the unique characteristics of South–South FDI flows be distinguished? We analyzed the manner of spillover inherent to FDI flow, and how that contributes to growth in general, particularly in the case of South–South FDI flows.

Recent empirical literature has stressed that the spillover effects of North–South FDI are quite plausible, as less productive firms may experience more benefits from foreign technology. Even though there is a well-known empirical and theoretical link between FDI and technology spillover, many empirical studies attribute their findings solely to North–North or North–South contents. However, research regarding South–South FDI spillover is quite rare. Therefore, the major contribution of this paper was to categorize the various forms of FDI by host and home countries, and to figure out the differences among them. In particular, we will focus on the effects of South–South FDI flows.

Using the data of OECD FDI Statistics and the UNCTAD FDI dataset, we determined that FDI has positive impacts on LDCs. Further, we determined that the impacts of the FDI from DCs tend to be more prevalent. That is, so-called North–South effects were found in this paper. We did not detect any so-called South–South effects, however. We also evaluated the other channel, imports, and determined its significant impacts on TFP.

Appendix: How FDI Data was Computed

For example the World economies consist of only four countries A, B, C, and D, where A and B are North countries, and C and D are South countries. Therefore A and B have all bilateral FDI data but C and D have only FDI data from (to) the World.

Appendix Table 1: Example Raw Data Set

Home Country	Host Country	flow_in	flow_out	Source
A	B	30 (i1)	20 (o1)	OECD.stat
A	C	17 (i2)	21 (o2)	OECD.stat
A	D	16 (i3)	25 (o3)	OECD.stat
B	A	20 (i4)	16 (o4)	OECD.stat
B	C	6 (i5)	15 (o5)	OECD.stat
B	D	9 (i6)	8 (o6)	OECD.stat
C	World	38 (i7)	23 (o7)	UNCTAD
D	World	34 (i8)	29 (o8)	UNCTAD

Source: Authors' compilation.

Appendix Table 2: Example Computed Data Set

Country	flow_in_n	flow_in_s	flow_out_n	flow_out_s
A	30 (= i1)	33 (= i2 + i3)	20 (= o1)	46 (= o2 + o3)
B	20 (= i4)	15 (= i5 + i6)	16 (= o4)	23 (= o5 +o6)
C	36 (= o2 + o5)	2 (= i7 - o2 - o5)	23 (= i2 + i5)	0 (= o7 - i2 - i5)
D	33 (= o3 + o6)	1(= i8 - o3 - o6)	25 (= i3 + i6)	4 (= o8 - i3 -i6)

Source: Authors' compilation.

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About the Paper

Hongshik Lee, Joonhyung Lee, and Hyuk-hwang Kim investigate whether foreign direct investment (FDI) has statistically significant effects on host countries' economic performance, such as total factor productivity. This paper evaluates whether these spillover effects depend on the sending countries' income levels, and shows that the impacts of FDI from developed countries, North–South effects, are more prevalent, but not the South–South effects.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than $2 a day, with 903 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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